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(54) Title: A CART UNIT

(57) Abstract

A cart unit for a conveyor is disclosed. The cart unit comprises a frame having frame part members and improved unifying means for unifying the frame part members. The unifying means comprise one or more pre–loaded wire ropes and stopping devices and are adapted so as to securely hold together the frame part members at large temperature variations. The stopping devices are tubular members which are plastically deformed by compression, thereby fixing the pre–loaded wire ropes. The cart unit further comprises wheels and wheel supports made from a vibration absorbing material, such as plastics material, thereby reducing the level of noise generated by the cart unit. A method for pre–loading and fixing a wire rope comprised in the the unifying means is further disclosed.

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A CART UNIT

Technical field

The present invention relates to a cart unit, in particular a cart unit for a conveyor, such as a sorter. In particular, the invention relates to improvements concerning of the frame part of the cart unit, improvements concerning means for unifying the parts of the frame and improvements concerning wheels and wheel supports.

Background of the invention

A known type of conveyor is disclosed in WO 90/09944. The frame parts of known conveyor carts are made, e.g., of aluminum or steel parts unified by welding or by means of pre-loaded bolts. While it is desirable to benefit from the lightness of aluminum, welding of aluminum may be technologically problematic, and unification by means of pre-loaded bolts may make the frame part sensitive to temperature variations and to vibrations that may loosen the bolts a little since the tensile stress of the pre-loaded bolts decreases rapidly if the extension of the bolt is decreased.

Another common problem of cart units is that they during operation cause a considerable noise level due to vibrations originating from the wheels of the cart unit and transferred to the remaining part of the unit.

One method of unifying construction parts is to connect them with one or more pre-loaded wire ropes. However, a problem may arise if a stopping device in form of a tubular member is fixed to the pre-loaded rope by plastically deforming the tubular member. The tubular member may extend in the longitudinal direction during the deformation process and may thereby exert a tensile stress on the rope. The sum of this tensile stress and the pre-loading force should not exceed the prescribed maximum tensile stress of the rope, for which

reason the upper limit for the pre-loading force will be rather low as compared to the prescribed maximum tensile stress.

One object of the invention is to provide a cart unit, the frame of which is made from unified parts in such a manner that it has high strength and high flexibility and is kept strongly together also in case the cart unit is subjected to temperature variation at least within 0-50 degrees Celcius, without requiring service or adjustments.

A further object of the present invention is to provide a wheel and wheel support for the cart unit with an ability to absorb vibrations so that vibrations from wheel are not fully transferred to the remaining of the cart unit, thereby reducing the noise level from the cart unit.

A yet further object of the present invention is to provide a stopping device for being fixed to a wire rope and a method for fixing the device to the rope, in particular for use in connection with a wire rope for the unification of the frame of the cart of the invention, the stopping device being designed so as to reduce the tensile stress it exerts to the rope when it is fixed to the rope by deformation of the stopping device. Thereby, the upper limit for a pre-loading force that may be applied to the rope without exceeding the prescribed maximum tensile stress of the rope may be increased.

Disclosure of the invention

One aspect of the invention relates to a cart unit, e.g. for a conveyor, the cart unit having a frame part comprising

a longitudinal member elongated substantially in a transport direction of the conveyor,

a transversal member mounted at a first end of the longitudinal member and elongated in a direction substantially perpendicular to the longitudinal member, and

a flexible elongated unifying means, such as a wire rope, the longitudinal member and the transversal member being unified by the pre-loaded flexible elongated unifying means engaging with both the longitudinal member and the transversal member so as to force them towards each other by tensile stress of the unifying means caused by the pre-loaded state of the unifying means.

The unifying means is required to be flexible by having a low coefficient of rigidity as compared to steel bolts and by being bendable. A steel wire rope has a coefficient of rigidity that is much lower than steel bolts and has therefore more suitable elastic properties. When being pre-loaded, steel wire rope may be stretched more than a steel bolt and does not loose as much tensile stress if it is allowed to contract a given amount from the pre-loaded state. Therefore, a cart unit that is kept together by the tensile stress of a wire rope is less sensitive to vibrations and temperature variations that may cause the tension of the unifying means to decrease as compared to a cart unit kept together by means of steel bolts.

Furthermore, the ability to bend allows one unifying means to extend between the two members of the frame part several times so that more than one part of the unifying means forces the members towards each other and all of the parts of the unifying means extending between the members may be pre-loaded by applying a pulling force to one end of the unifying means.

Thus, one part of the unifying means may engage with one of the frame members and two parts of the unifying means may engage with the other of said members of the frame part in one embodiment of the cart unit according to the invention so that two parts of the unifying means extend between the two members. Similarly, in an other embodiment of the invention, two parts of the unifying means engage with one of said members of the frame part and three parts of the unifying

means engage with the other of said members of the frame part so that at least four parts of the unifying means extend between said two members of the frame part, the two members of the frame part being forced towards each other by the tensile stresses of at least said four parts of the unifying means.

Any number of parts of the unifying means may, according to the invention, extend between the parts of the frame part.

The cart unit may engage with tracks in a number of way, such as e.g. with slide shoes, but the cart unit preferably comprises two wheel units, each of the two wheel units being arranged at one of the two end parts of the transversal member and each of said two wheel units comprising

at least one wheel adapted for engaging with a track of said conveyor, and

a wheel supporting member on which the at least one wheel is arranged so that the wheel is allowed to rotate about a first axis, the wheel supporting member being at least partly made of a material with an ability to absorb vibrations transferred from the at least one wheel and arriving at the frame part, thereby reducing the noise level from the cart unit.

The ability to absorb vibrations enables the wheel supporting member to reduce the amplitude of the vibrations transmitted from the wheel to the remaining part of the frame part.

Suitable vibration-absorbing materials are plastics material such as, e.g. polyamide, preferably reinforced with fibres. Thus, e.g., castable glass fibre-reinforced polyamide 6 has been found to be an excellent material for this purpose. An example of such a material is sold by BASF under the designation B3WG10; it is a castable polyamide 6 material containing about 50% by weight of short glass fibres.

The wheel supporting member of each wheel unit is preferably arranged on the frame part of a cart unit in such a way that it may pivot about a second axis that is substantially perpendicular to the axis about which the wheel rotates so that the wheel is able to follow curvatures of the track.

Also the wheel itself is preferably made of a material with an ability to absorb vibrations so as to reduce noise generated when the wheel engages with the track. A suitable material showing these desirable properties is a plastics material such as polyamide, e.g. polyamide 6. The axle on which the wheel with its bearing is mounted can suitably be made of the same plastics material as the wheel supporting member. The rim of the wheel is suitably made of a plastics material of a suitable hardness, such as a hardness in the Shore A range, e.g. Shore 80-100 such as Shore 85-95. An example of such a material is polyurethane Shore 90-92 plus/minus 3.

It is preferred that the wheel-supporting member pivots about an axle made of a plastics material. A material which has been found to has excellent wear properties when subjected to contact a wheel supporting member made of the glass fibre-reinforced polyamide 6 mentioned above is as a fibre-reinforced polyoxyalkylene material, such as polyoxymethylene admixed with a minor proportion of polytetrafluoroethylene. An excellent material of this type consists essentially of about 70% by weight of polyoxymethylene, about 15% by weight of polytetrafluoroethylene, about 10% by weight of short carbon fibres and about 5% by weight of Kevlar fibres.

It is evident that the special wheel members described above would be useful also for other conveyor carts than the carts of the special frame construction described above, and an aspect of the invention, therefore, relates to a cart unit for a conveyor and comprising wheel units, individual wheel units comprising

at least one wheel adapted for engaging with a track of said conveyor, and

a wheel supporting member on which the at least one wheel is arranged so that the wheel is allowed to rotate about a first axis, the wheel supporting member being at least partly made of a material with an ability to absorb vibrations transferred from the at least one wheel, thereby reducing the noise level from the cart unit, the wheels and wheel members preferably showing the features and advantages discussed above.

For adapting the cart unit for conveying articles along the conveyor, each unit may comprise an article-supporting member with an article-supporting upper surface that is substantially horizontal during a substantial part of an operating period of said conveyor. This article-supporting member may be tiltably arranged on the frame part so that articles positioned on the article-supporting member may be discharged by tilting of the article-supporting member at a selected position along the path at which the cart unit moves during operation. Alternatively, the article-supporting member may comprise an endless cross-belt that may be driven in either direction transverse to the transport direction so as to discharge an article positioned thereon.

The cart units may be driven along the track of the conveyor by one or more drive chains, by stationary motors arranged along the track, each motor being provided with a wheel arranged to engage with the passing cart units, by electric drive motors on a number of the units etc. A suitable device for driving the cart units is linear motors with their stationary parts arranged along the track. For interacting with these stationary parts, each cart unit comprises an elongated plate made of a magnetic material, such as steel, the plate being positioned at the lower side of the longitudinal member and extending substantially from a second end part and past the first end of the longitudinal member and further past a substantial part of the transversal member, the plate being adapted to interact with at least one stationary part of a linear motor of the conveyor.

The distance between the plates of immediately adjacent cart units were reduced from 110 mm to 30 mm by letting the plates protrude under the transversal members and the effect of the linear motors on the cart units were thereby increased as the stationary part were enabled to interact with a larger plate.

The frame part may further comprise a covering member made of a non-magnetic electrically conducting material, such as aluminium. The covering member is positioned under the plate and covering a substantial part of the plate so as to enhance the efficiency of the linear motor which is a well-known effect.

The unifying means of the frame part may be a wire rope, and a method for pre-loading and fixing a wire rope which is fixed at an upstream position is part of the invention. The method comprises the steps of

positioning a downstream part of the rope in an opening in a solid member in such a manner that the part extends to a downstream side of the opening,

applying a stopping device comprising a tubular member with at least one indentation to the downstream extending part of the rope, the stopping device having such cross-section dimensions that it is unable to pass the opening also when it is in its later compressed state,

applying a pulling force to a downstream part of the rope so as to pre-load the rope and thereby cause a tensile stress in the rope,

positioning the stopping device adjacent to the opening so that one end of the tubular member of the stopping device is substantially abutting the surface of the solid member, and

applying a compression force to an outer surface of the tubular member in a direction transverse to the axis of the opening whereby the tubular member is plastically deformed so that the outer diameter of the tubular member decreases, the at least one indentation is at least partly filled with material due to the deformation process, and the rope part is

wedged tight to a substantial part of the inner wall of the tubular member.

A stopping device for being arranged around and fix a part of a rope, e.g. for use in the above-described method, is also provided according to the invention. The stopping device comprises a tubular member with a substantially cylindrical axial opening for receiving the rope part and the tubular member is adapted for being plastically deformed by compression in a direction transverse to the axis of the opening. The rope part is thereby being wedged tight to a substantial part of the inner wall of the tubular member. The tubular member is provided with at least one indentation in an outer surface so that part of the material of the tubular member is allowed to spread into and at least partly fill the indentation with material during the plastic deformation process.

It empirically been found that a wire rope with a prescribed maximum pulling force of 2000 kg, being pre-loaded with a pulling force of 1000 kg may break if a tubular member without indentations is arranged around it and compressed into plastic deformation. This might be because the material of the tubular member spreads in the longitudinal direction of the tubular member so that the member is elongated by the compression, and thereby is exerting an additional tensile force on the part of the wire inside the opening. As a consequence hereof, the pre-loading force must be considerably below the prescribed maximum pulling force in order to prevent the wire from breaking.

However, if the tubular member is provided with indentations in the outer surface, the material might spread into these indentations and the tubular member is less elongated by the compression. The result of the indentations is, that the wire rope may be pre-loaded with a considerably higher force than when tubular members without indentations are used.

The tubular member of the stopping device may be monolithic, i.e. consisting of one piece, or the tubular member may be made of two pieces that are placed around a wire rope. The plastic deformation due to the compression of the tubular members will during the compression merge the two parts together.

The stopping device may be provided with at least one indentation that extends over at least a substantial part of a circumference of the outer surface and has a depth within 30-90% of the wall thickness of the tubular member, preferably within 40-80% of the wall thickness and most preferred within 50-70% of the wall thickness, and an average width within 55-145% of the wall thickness of the tubular member, preferably within 70-130% of the wall thickness and most preferred within 85-115% of the wall thickness.

The indentations may be placed anywhere along the tubular member, but preferably at least 25%, most preferred at least 35% of the total length of the tubular member from each end.

In one embodiment of the invention, the tubular member is being provided with two indentations positioned in substantially the same cross-section of the tubular member, said cross-section being positioned approximately at the middle of the tubular member in the longitudinal direction, said indentations being of a depth within 50-70 % of the wall thickness, and being of an average width within 85-115 % of the wall thickness.

The tubular member may in general be used for fixing a part of a wire rope with a method comprising the steps of

positioning the part of the rope in the axial opening of the tubular member,

applying a compression force to an outer surface of the tubular member in a direction transverse to the axis of the opening whereby the tubular member is plastically deformed so that the outer diameter of the tubular member decreases, the

at least one indentation is at least partly filled with material due to the plastic deformation process, and the rope part is wedged tight to a substantial part of the inner wall of the tubular member.

Brief description of the drawings

Fig. 1 shows a perspective view of a part of a conveyor having a multiple of cart units according to the present invention,

Fig. 2 shows a perspective view of a cart unit according to the present invention mounted on a conveyor track,

Fig. 3 shows a perspective elevated view of a cart unit according to the present invention with a part broken away,

Fig. 4 shows a perspective elevated view of a cart unit according to the present invention and the transport direction of the conveyor,

Fig. 5 shows a perspective view of a cart unit according to the present invention,

Fig. 6 shows the profile of the longitudinal member of a cart unit according to the present invention,

Fig. 7 shows a perspective view of the transversal member of a cart unit according to the present invention,

Fig. 8 shows the same as Fig. 7, but from a reverse angle,

Fig. 9 shows an elevated view of a second connecting member,

Fig. 10 shows a perspective view of the second connecting member,

Fig 11 shows the same as Fig. 10, but from a reverse angle,

Fig. 12 shows a perspective view of a stopping device according to the present invention,

Fig. 13 shows the same as Fig. 12, but from a reverse angle,

Detailed description of the drawings

Fig. 1 shows a part of a conveyor 10 having a multiple of mutually attached cart units 11 according to the present invention. The drawing shows six cart units 11. Each of the cart units comprises a longitudinal member 12 and a transversal member 13. They further comprise two wheels 14. The conveyor comprises two tracks 15, wherein the wheels 14 of the cart units are arranged. The cart units 11 are thereby being guided along the conveyor 10. Five of the cart units shown on the drawing comprise an article supporting upper surface 16, 17 for carrying articles to be conveyed by the conveyor 1. The surfaces 16, 17 are kept substantially horizontally during the normal operation mode of the conveyor 1, so that the articles to be conveyed are kept on the article supporting upper surfaces 16, 17 during the transportation. The cart units 11 are capable of tilting the article supporting upper surfaces 16, 17 in a direction being substantially perpendicular to the transport direction of the conveyor 1, so as to discharge an article being conveyed. The article supporting upper surfaces 16, 17 can be tilted when the cart unit 11 is in a certain position along the path of the conveyor 1, where the article being conveyed is destined. One of the article supporting upper surfaces 17 is shown in the tilted position.

The conveyor 1 may be an endless conveyor.

Fig. 2 shows a cart unit 11 according to the present invention mounted on a pair of conveyor tracks 15. The cart unit comprises a longitudinal member 12 elongated substantially in the transport direction of the conveyor and a transversal member 13 elongated substantially

perpendicularly to the longitudinal member. The longitudinal member 12 and the transversal member are preferably made from aluminium, providing a low weight cart unit. The cart unit 11 further comprises an article supporting upper surface 16 and means 18 for tilting the article supporting upper surface 16 in a direction substantially perpendicular to the transport direction of the conveyor. The cart unit further comprises wheels 14 engaging with the conveyor tracks 15. The wheels are made from a plastic material as described above. This reduces the noise created by the conveyor as compared to other conveyors.

Figs. 3-5 show a cart unit according to the present invention. Fig. 3 shows the cart unit with a part broken away. The cart unit comprises a longitudinal 12 and a transversal 13 member. The cart unit further comprises two wheel units 19 arranged near the ends of the transversal member. The wheel units 19 are made from a plastics material like the wheels 14 and as described above. This reduces the noise level even further. The wheel units 19 each comprise a wheel 14. The wheel units 19 are capable of pivoting around axes 20 thereby allowing the cart unit to follow the conveyor tracks if they turn in a substantially horizontal plane. The cart unit further comprises a first connecting member 21 positioned at the transversal member 13, comprising a groove 22 for receiving a part of a wire rope, and a second connecting member 23 adapted for receiving the first connecting member 21 of another identical cart unit. Two cart units may thus be interconnected by introducing a pivot pin 24 through holes 25, 26 in the first 21 and second 23 connecting members. Such an interconnection allows the cart units to move pivotally with respect to each other.

Inside the longitudinal member 12 pieces of wire rope 27 are elongated along the direction of the longitudinal member 12. The wire rope 27 is preferably a 5 mm steel wire rope. The longitudinal 12 and the transversal 13 members are unified by the wire rope 27 in the following way. The wire rope 27 is

led through the transversal member 13 and along the longitudinal member 12. It is further led around a groove (not shown) comprised in the second connecting member 23. It is then led back along the longitudinal member 12, through the transversal member 13 and around the groove 22 comprised in the first connecting member 22. The wire rope 27 is then once again led through the transversal member 13, along the longitudinal member 12, around another groove (not shown) comprised in the second connecting member 23, back along the longitudinal member 12 and through the transversal member 13. The wire rope 27 is pre-loaded and the ends of the rope are fixed by stopping devices 28 in the following way. The ends of the wire rope 27 are received in axial openings in the stopping devices 28. Each of the stopping devices 28 are then being plastically deformed by compression in a direction transversal to the axis of the opening. This abuts the stopping devices 28 against the transversal member 13. The pre-loaded wire rope 27 thereby forces the longitudinal 12 and the transversal 13 members towards each other and the abutted stopping devices 28 fix them in this position.

The cart unit further comprises guiding wheels 29 for guiding the cart unit. The guiding wheels are made from a plastic material as the other wheels and as described above.

The cart unit further comprises a wire 30 for electrically discharging the cart unit so as to prevent electric currents from being build up.

The cart unit further comprises a plate 31 positioned on the side of the cart unit. The plate 31 comprises clock holes 32 positioned equidistantly along the length of the plate 31 in a clock line. When the cart unit is moving along the conveyor the velocity of the cart unit may be measured by one or more stationary photo cells (not shown) positioned along the path of the conveyor and pointed at the clock holes 32. The plate 31 further comprises identification means 33. The identification means may comprise several fields that may be

easily removed by, e.g., pushing, stamping or punching. By removing some of the fields the resulting holes and the remaining fields together represents a binary code. By choosing different binary codes for different cart units the cart units can be uniquely identified. The identification means may however be other kinds, such as, e.g., bar codes.

Fig. 5 further shows a covering member 34 positioned below the lower part of the longitudinal member 12. The covering member 34 will be further described below in connection with Fig. 6.

Fig. 6 shows the profile of the longitudinal member 12. The longitudinal member has downwardly extending parts 35 comprising grooves 36 adapted for engaging with upwardly extending parts 37 of a covering member 34 being positioned below the longitudinal member 12. A cavity 38 is hereby formed between the lower part of the longitudinal member 12 and the covering member 34. In this cavity 38 a plate made from a magnetic material (not shown), such as steel, may be placed, the plate being adapted to interact with at least one stationary part of a linear motor (not shown) of the conveyor. The covering member 34 may be made from a non-magnetic electrically conducting material, such as aluminium. Thus, the active side of the plate made from a magnetic material is covered by a layer of electrically conducting but non-magnetic material, which is known to enhance the affectivity of the linear drive.

When the profile shown in Fig. 6 and the plate made from a magnetic material (not shown) are assembled, the plate is fixed to the covering member 34 by, e.g., double sticky tape. The covering member 34 and the lower part of the longitudinal member 12 are then forced together under a great pressure establishing a strong connection between the two parts.

Figs. 7 and 8 show the transversal member 13 as seen from two different angles. The transversal member 13 comprises holes

39 for receiving pivots around which wheel units may pivot. It further comprises a first connecting member 21 for connecting two identical cart units. The first connecting member 21 comprises a groove 22 for receiving a wire rope an a hole 25 for receiving a pivot pin so as to pivotally interconnect two identical cart units.

The transversal member 13 further comprises aluminium axels 40 cast together with the transversal member 13 and protruding downwardly. The axels 40 are adapted for receiving guiding wheels. Casting the axels together with the transversal member reduces noise.

Figs. 9-11 show a second connecting member 23 for interconnecting two identical cart units. The second connecting member 23 is attached to the longitudinal member at the end positioned opposite to the transversal member. It comprises a back plate 41 capable of being fitted to the end of the transversal member. It further comprises two horizontally extending pieces 42 attached to the back plate 41. The horizontally extending pieces 42 comprise coaxially positioned holes. When two identical cart units are interconnected a first connecting member 21, positioned on the transversal member of one cart unit, is received between the two horizontally extending pieces 42 of the second connecting member 23 of the other cart unit in a manner so that the holes 25, 26 are coaxial. The connecting members 21, 23 are then connected by introducing a pivot pin into the holes. Thus, the cart units are interconnected and capable of moving pivotally with respect to each other. The first 21 and second 23 connecting members are preferably made from aluminium.

Figs. 12 and 13 show perspective views of a stopping device 28 as seen from different angles. The stopping device 28 is preferably substantially cylindrical and has a substantially cylindrical axial opening 43 extending through the stopping device 28 along the length of stopping device. The hole 43 is

preferably slightly conical so as to allow an end of a wire rope to be easier introduced into the stopping device 28. The stopping device further comprises one or more indentations 44 as described above. The one or more indentations 44 are preferably made by squeezing part of the material away, but they may also be made by, e.g., milling. When the stopping device 28 is compressed at least part of the material of the stopping device 28 will spread into the one or more indentations 44, at least partly filling the indentations. This provides a stronger grip on the wire rope positioned inside the stopping device 28 as compared to when the one or more indentations 44 are not present.

CLAIMS

1. A cart unit, e.g. for a conveyor, the cart unit having a frame part comprising

a longitudinal member elongated substantially in a transport direction of the conveyor,

a transversal member mounted at a first end of the longitudinal member and elongated in a direction substantially perpendicular to the longitudinal member, and

a flexible elongated unifying means, such as a wire rope, the longitudinal member and the transversal member being unified by the pre-loaded flexible elongated unifying means engaging with both the longitudinal member and the transversal member so as to force them towards each other by tensile stress of the unifying means caused by the pre-loaded state of the unifying means.

2. A cart unit according to claim 1, wherein at least one part of the unifying means engages with one of said members of the frame part and at least two parts of the unifying means engage with the other of said members of the frame part so that at least two parts of the unifying means extend between said two members of the frame part, the two members of the frame part being forced towards each other by the tensile stresses of at least said two parts of the unifying means.

3. A cart unit according to claim 1, wherein at least two parts of the unifying means engage with one of said members of the frame part and at least three parts of the unifying means engage with the other of said members of the frame part so that at least four parts of the unifying means extend between said two members of the frame part, the two members of the frame part being forced towards each other by the tensile stresses of at least said four parts of the unifying means.

4. A cart unit according to any of the preceding claims and further comprising two wheel units, each of the two wheel units being arranged at one of the two end parts of the transversal member and each of said two wheel units comprising

at least one wheel adapted for engaging with a track of said conveyor, and

a wheel supporting member on which the at least one wheel is arranged so that the wheel is allowed to rotate about a first axis, the wheel supporting member being at least partly made of a material with an ability to absorb vibrations transferred from the at least one wheel and arriving at the frame part, thereby reducing the noise level from the cart unit.

5. A cart unit according to claim 4, wherein the wheel supporting member is made of a plastics material such as polyamide.

6. A cart unit according to claim 5, wherein the plastics material is reinforced with fibres.

7. A cart unit according to claim 6, wherein the plastics material is glass fibre-reinforced polyamide 6.

8. A cart unit according to any of claims 4-7, wherein the wheel supporting member of each wheel unit is arranged on the frame part of a cart unit so that it may pivot about a second axis that is substantially perpendicular to said first axis.

9. A cart unit according to any of claims 4-8, wherein at least a part of the at least one wheel of each wheel unit is made of a material with an ability to absorb vibrations so as to reduce noise generated when the wheel engages with the track.

10. A cart unit according to claim 9, wherein the wheel is made of a plastics material such as polyamide, and has a rim

made of a plastics material of a hardness in the Shore A range, such as polyurethane.

11. A cart unit according to claim 9 or 10, wherein the wheel has an axle made of a plastics material such as glass fibre-reinforced polyamide 6.

12. A cart unit according to any of claims 4-11, wherein the wheel-supporting member pivots about an axle made of a plastics material such as a fibre-reinforced polyoxyalkylene material.

13. A cart unit according to claim 12, wherein the polyoxyalkylene material is polyoxymethylene admixed with polytetrafluoroethylene.

14. A cart unit according to claim 12 or 13, wherein the fibre reinforcement comprises fibres selected from carbon fibres and Kevlar fibres and mixtures thereof.

15. A cart unit for a conveyor and comprising wheel units, individual wheel units comprising

at least one wheel adapted for engaging with a track of said conveyor, and

a wheel supporting member on which the at least one wheel is arranged so that the wheel is allowed to rotate about a first axis, the wheel supporting member being at least partly made of a material with an ability to absorb vibrations transferred from the at least one wheel, thereby reducing the noise level from the cart unit.

16. A cart unit according to claim 15, which shows the features claimed in any of claims 5-14.

17. A cart unit according to any of claims 1-14 and comprising an article-supporting member with an article-supporting upper surface that is substantially horizontal

during a substantial part of an operating period of said conveyor.

18. A cart unit according to claim 17, wherein the article-supporting member is tiltably arranged on the frame part so that articles positioned on the article-supporting member may be discharged by tilting of the article-supporting member at a selected position along the path at which the cart unit moves during operation.

19. A cart unit according to any of claims 1-14 and 17-18, wherein the frame part comprises an elongated plate made of a magnetic material, such as steel, the plate being positioned at the lower side of the longitudinal member and extending substantially from a second end part and past the first end of the longitudinal member and further past a substantial part of the transversal member, the plate being adapted to interact with at least one stationary part of a linear motor of the conveyor.

20. A cart unit according to claim 19, wherein the frame part comprises a covering member made of a non-magnetic electrically conducting material, such as aluminium, the covering member being positioned under the plate and covering a substantial part of the plate so as to enhance the efficiency of the linear motor.

21. A stopping device for being arranged around and fix a part of a rope, the stopping device comprising a tubular member with a substantially cylindrical axial opening for receiving the rope part, the tubular member being adapted to be plastically deformed by compression in a direction transverse to the axis of the opening, the rope part thereby being wedged tight to a substantial part of the inner wall of the tubular member, said tubular member being provided with at least one indentation in an outer surface so that part of the material of the tubular member is allowed to spread into

and at least partly fill the indentation with material during the plastic deformation process.

22. A stopping device according to claim 201, wherein the tubular member is monolithic.

23. A stopping device according to claim 21 or 22, wherein the at least one indentation extends over at least a substantial part of a circumference of the outer surface and has a depth within 30-90% of the wall thickness of the tubular member and an average width within 55-145% of the wall thickness of the tubular member.

24. A stopping device according to any of claims 21-23, wherein the at least one indentation is positioned at least 25% of the total length of the tubular member from each end.

25. A method for fixing a part of a wire rope in a stopping device as claimed in any of claims 21-24, the method comprising the steps of

positioning the part of the rope in the axial opening of the tubular member,

applying a compression force to an outer surface of the tubular member in a direction transverse to the axis of the opening whereby the tubular member is plastically deformed so that the outer diameter of the tubular member decreases, the at least one indentation is at least partly filled with material due to the plastic deformation process, and the rope part is wedged tight to a substantial part of the inner wall of the tubular member.

26. A method for pre-loading and fixing a wire rope which is fixed at an upstream position, the method comprising the steps of

positioning a downstream part of the rope in an opening in a solid member in such a manner that the part extends to a downstream side of the opening,

applying a stopping device as claimed in any of claims 21-24 to the downstream extending part of the rope, the stopping device having such cross-section dimensions that it is unable to pass the opening also when it is in its later compressed state,

applying a pulling force to a downstream part of the rope so as to pre-load the rope and thereby cause a tensile stress in the rope,

positioning the stopping device adjacent to the opening so that one end of the tubular member of the stopping device is substantially abutting the surface of the solid member, and

applying a compression force to an outer surface of the tubular member in a direction transverse to the axis of the opening whereby the tubular member is plastically deformed so that the outer diameter of the tubular member decreases, the at least one indentation is at least partly filled with material due to the deformation process, and the rope part is wedged tight to a substantial part of the inner wall of the tubular member.

27. A cart unit according to any of claims 1-3, wherein the unifying means has been pre-loaded and fixed according to the method claimed in claim 26.

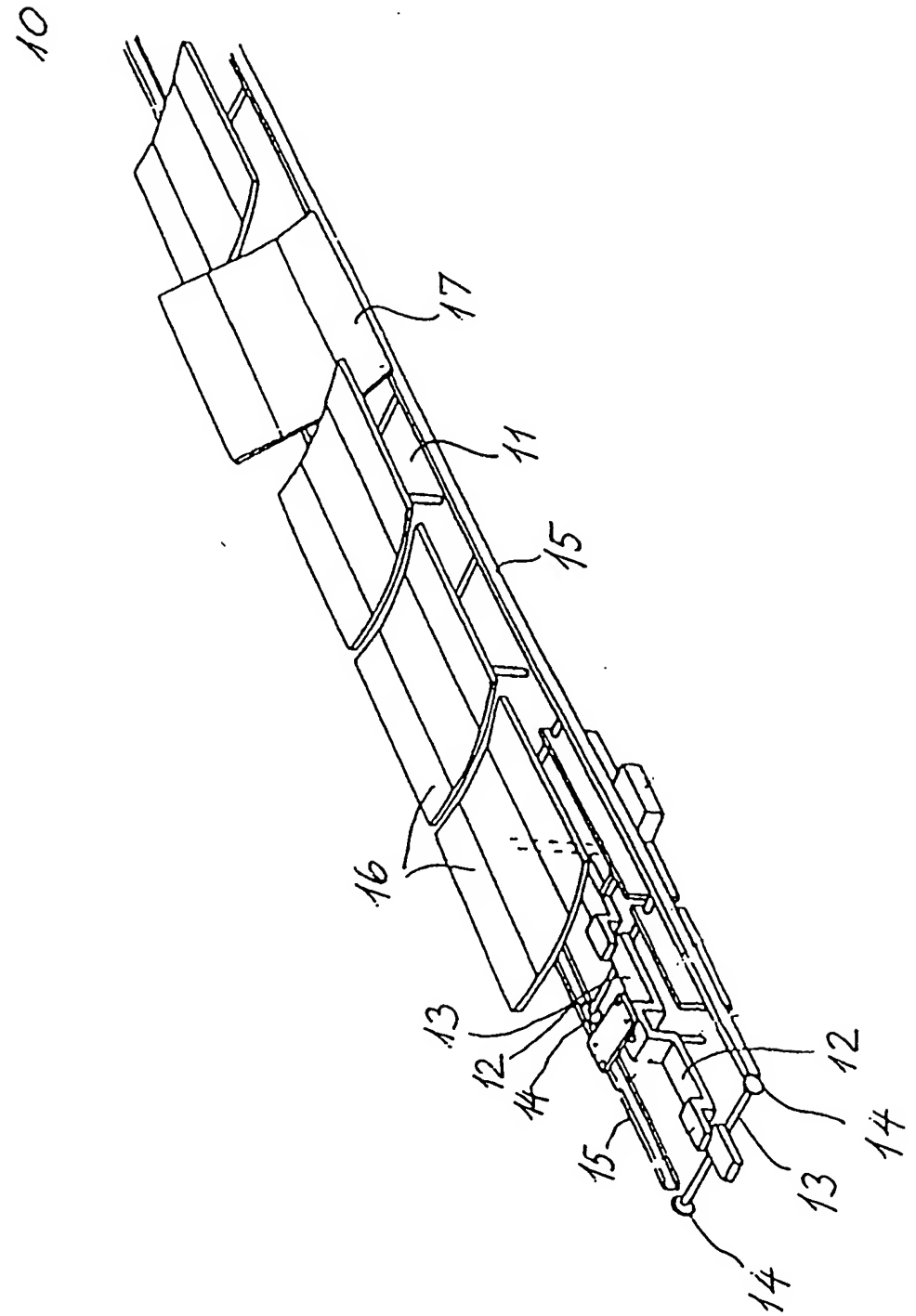

Fig. 1

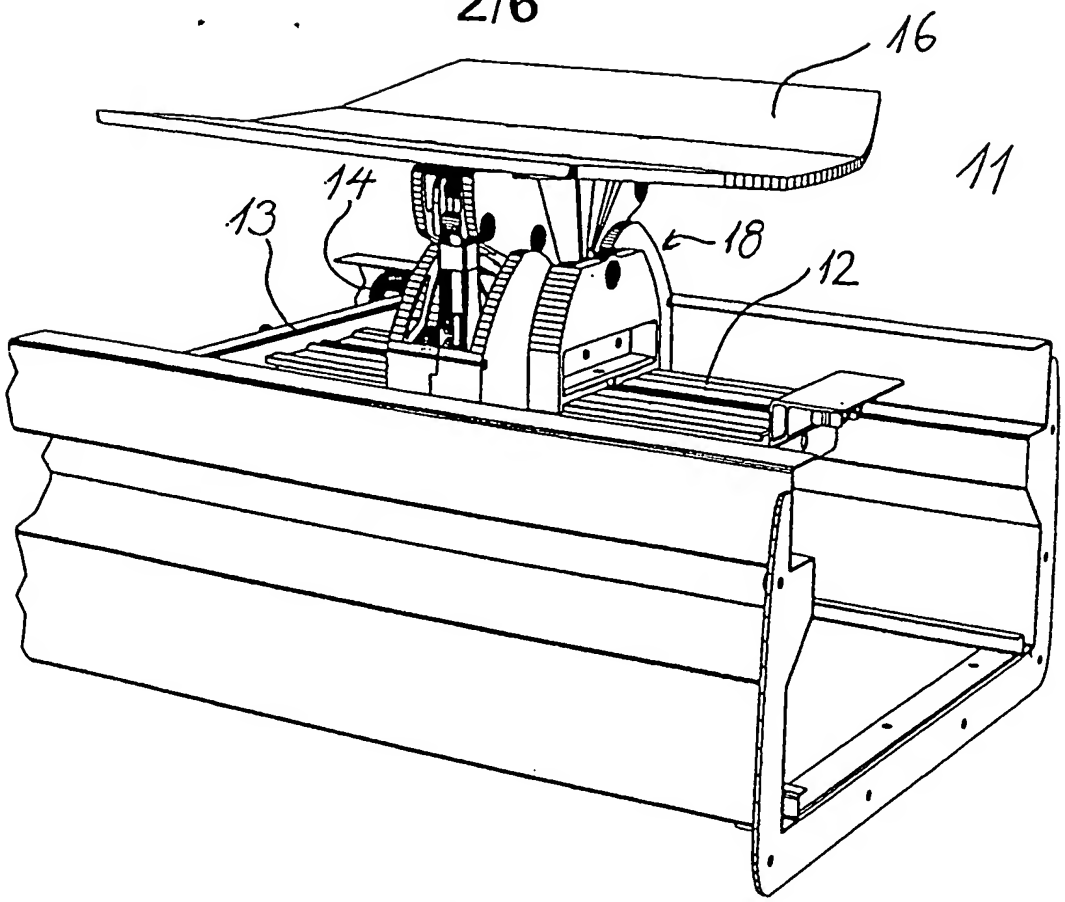
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Fig. 2

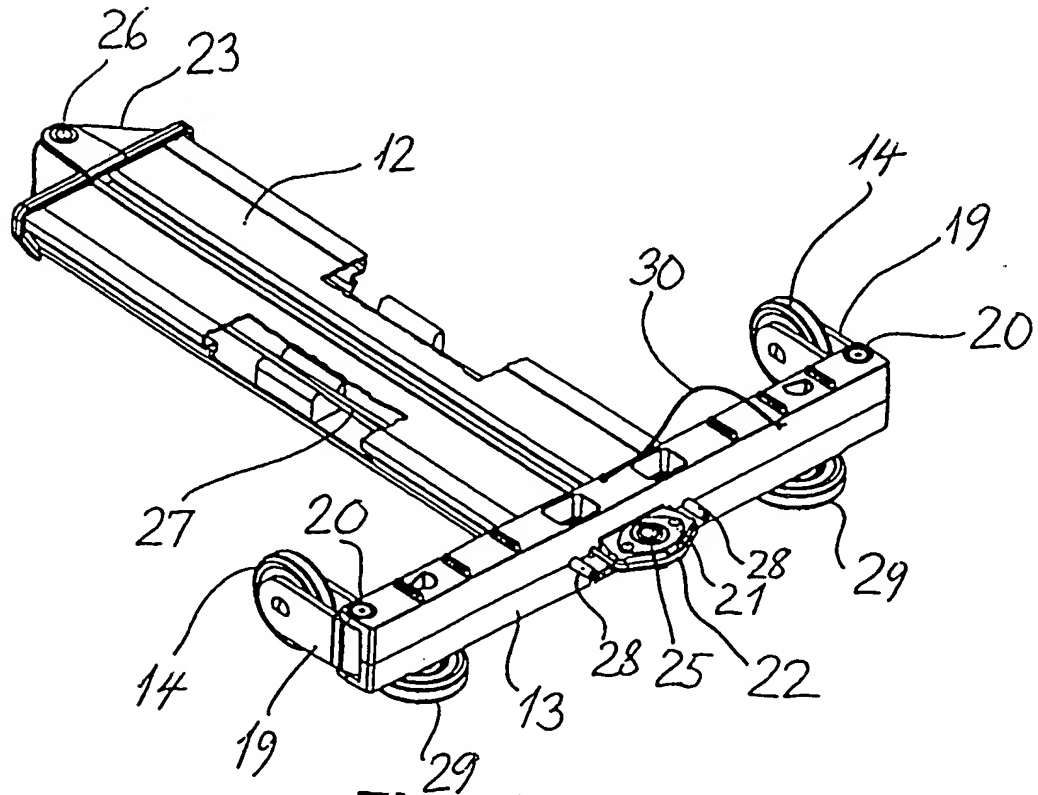
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Fig. 3

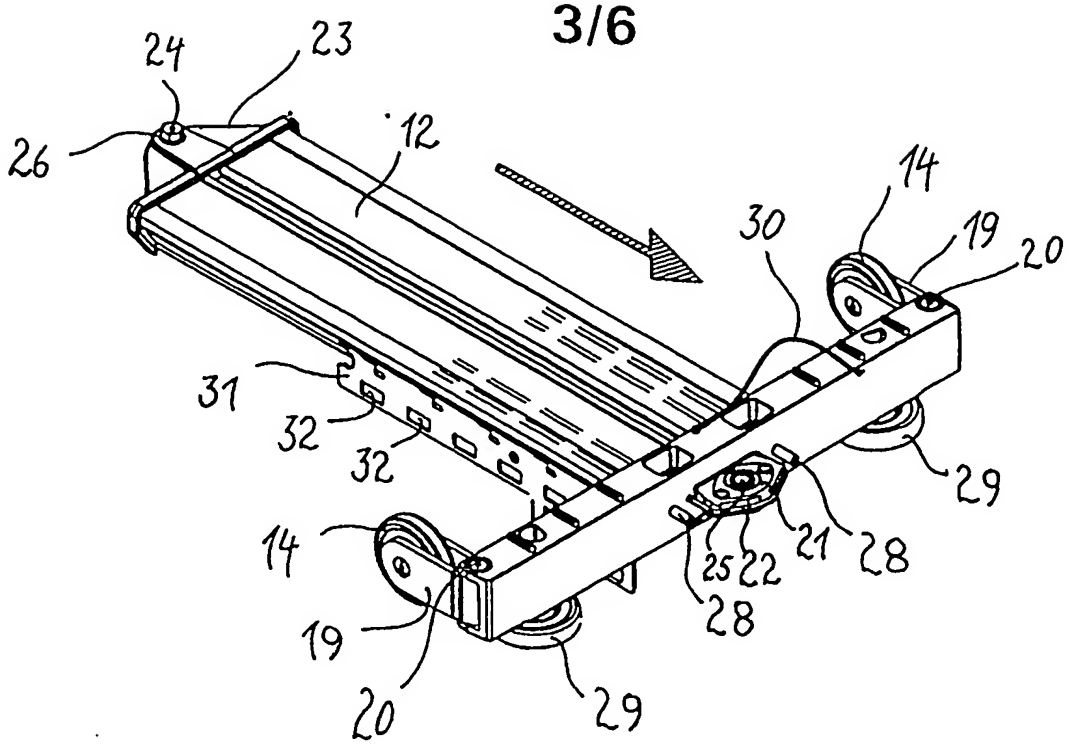
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Fig. 4

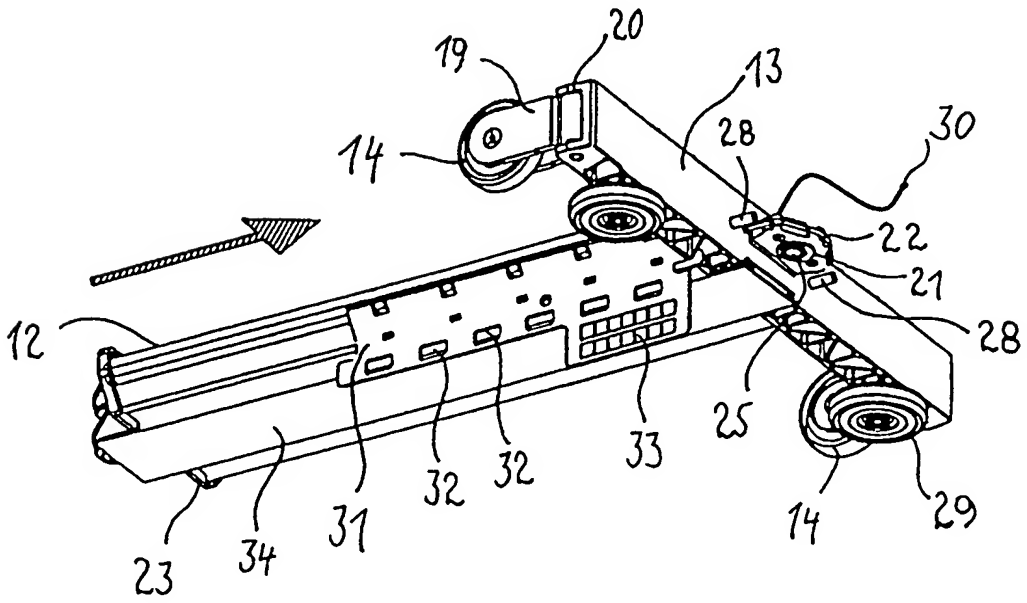
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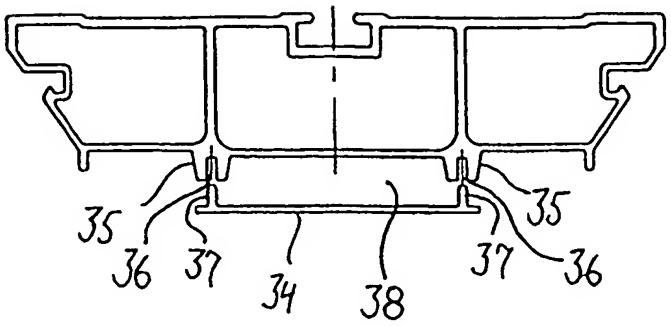
Fig. 5



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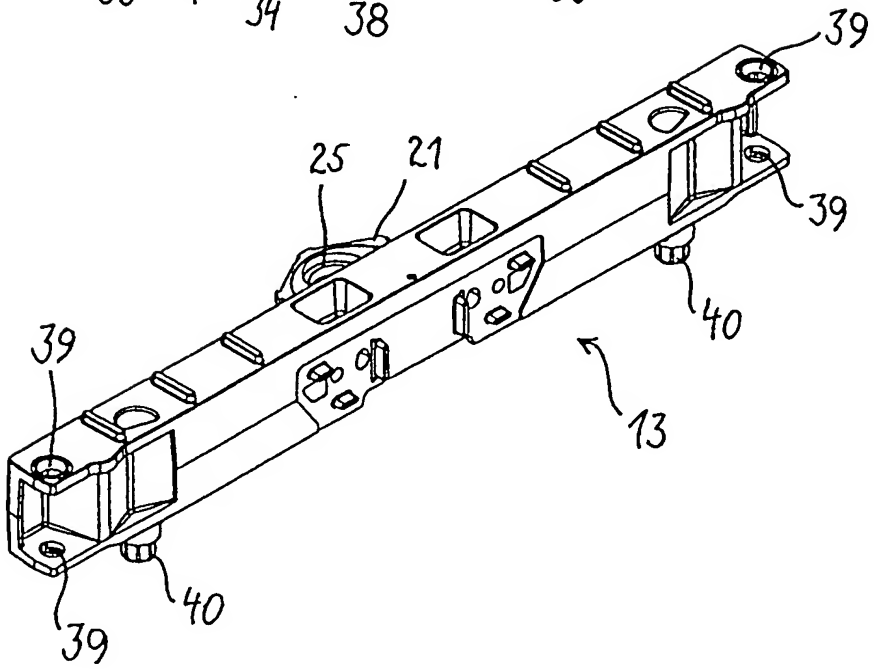

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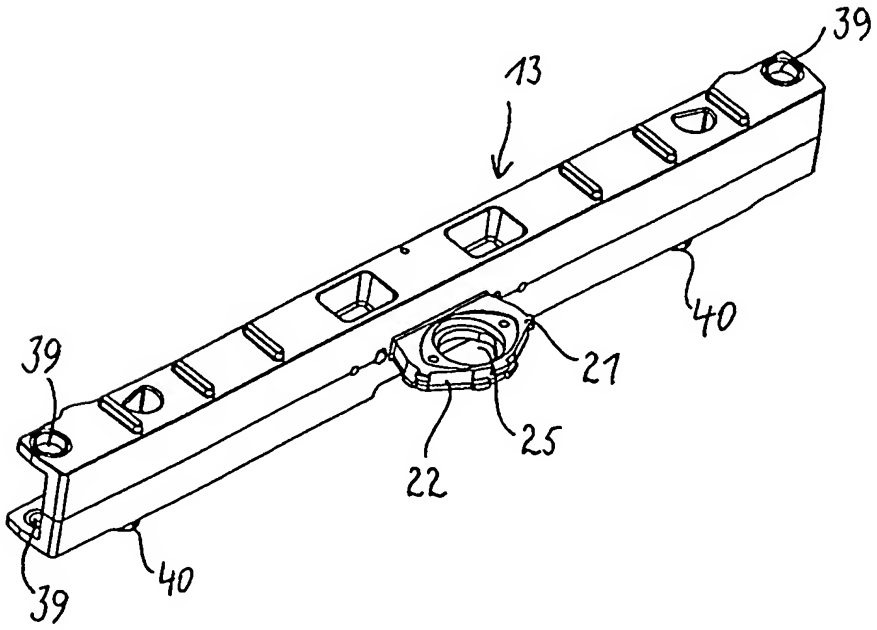

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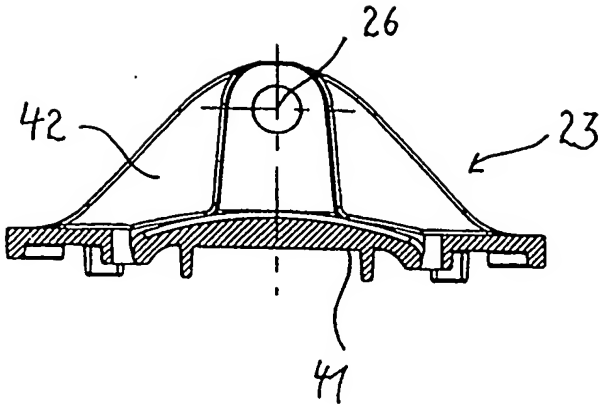

Fig. 9

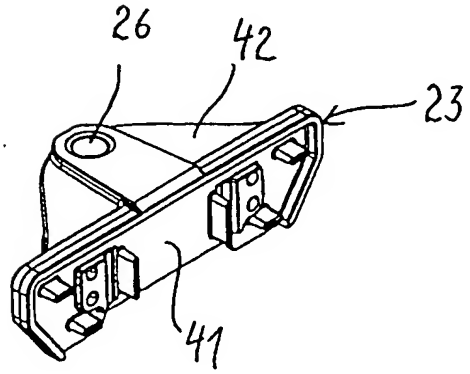

Fig. 10

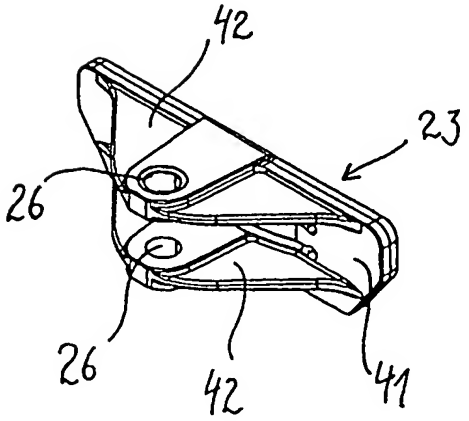

Fig. 11

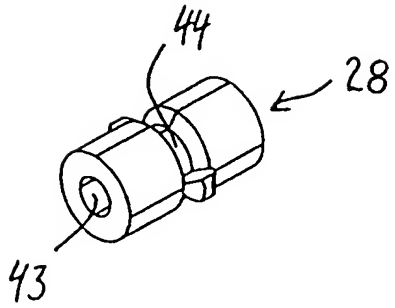

Fig. 12

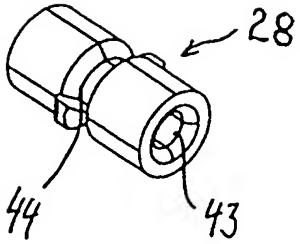

Fig. 13

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(74) Agent: PLOUGMANN & VINGTOFT & PARTNERS A/S; Sankt Annæ Plads 11, P.O. Box 3007, DK-1021 Copenhagen K (DK).

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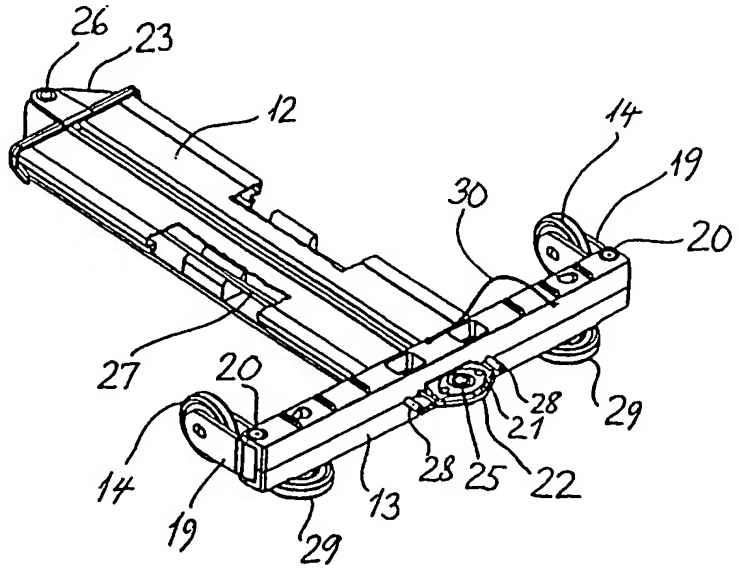
(54) Title: CART UNIT FOR A CONVEYOR



(57) Abstract

The cart unit (11) comprises a frame having frame part members (12, 13) and unifying means for unifying the frame part members. The unifying means comprise one or more pre-loaded wire ropes (27) and stopping devices (28) and are adapted so as to securely hold together the frame part members at large temperature variations. The stopping devices are tubular members which are plastically deformed by compression, thereby fixing the pre-loaded wire ropes. The cart unit further comprises wheels (14) and wheel supports (9) made from a vibration absorbing material, such as plastics material, thereby reducing the level of noise generated by the cart unit. A method for pre-loading and fixing a wire rope comprised in the the unifying means is further disclosed.

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65G F16G B61B B60B

Documentation searched other than minimumdocumentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 33669 A (GRAPHA-HOLDING AG) 14 December 1995 see page 1, line 20 - page 2, line 1 see page 2, line 16 - page 3, line 3 see figures 1,2	1,4,8, 15-18
A	US 5 267 514 A (J. STAEHS ET AL.) 7 December 1993 see column 3, line 30 - column 4, line 56 see figures 1-5	1,4,8,9, 15,16,19
A	WO 90 09944 A (KOSAN CRISPLANT A/S) 7 September 1990 cited in the application see page 4, line 10 - page 5, line 13 see figures 1-3	1,4,15, 17-20

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 October 1998	21.10.98

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Smolders, R

Int ional Application No
PCT/DK 98/00002

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 510 014 A (R. SPEAKER ET AL.) 5 May 1970 see column 3, line 51 - line 63 see figure 2	1,4,9, 15,16
A	DE 32 36 838 A (FILM-GERÄTE-VERLEIH SCHMIDLE & FITZ) 5 April 1984 see page 6, line 14 - page 7, line 33 see figures 1,2	15
A	US 4 457 395 A (H. ERNST ET AL.) 3 July 1984 see column 2, line 16 - line 62 see figure 1	15

INTERNATIONAL SEARCH REPORT

In..ational application No.
PCT/DK 98/00002

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

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3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

1-20,27

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

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☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/DK 98/00002

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-14, 17-20, 27

   Cart unit for a conveyor, the cart unit having a frame comprising a longitudinal member and a transversal member, and a pre-loaded wire rope to unify these two frame members.

2. Claims: 15-16

   Cart unit for a conveyor, the cart unit having wheel units comprising a wheel and a wheel supporting member being partially made of a shock absorbing material.

3. Claims: 21-26

   Stopping device for being arranged around and fixed to a part of a rope and method for fixing a wire rope in a stopping device.

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